Thesis Summary

The International Convention on Biological Diversity commits all parties including India to inventory monitor and conserve their biodiversity resources This is an enormous task even for a part of the country such as the Western Ghats – a hill chain running parallel to the west coast for over 1600 km considered as one of the world s biodiversity hot-spots (latitude 8° 21°N longitude 73° 77°E) Remote sensing has tremendous potential for this purpose as it can provide information about the structure and possibly composition of vegetation over large areas at a glance

However given India s heterogeneous and species rich landscapes direct mapping of stands of individual plants is not possible Remote sensing can instead be used to map the distribution of ecosystem types, or landscape element types (LSE types) These maps can then be correlated with species distributions within LSE types to derive information about diversity at the species level of the Western Ghats It is however necessary to assess the extent to which a purely remote-sensing based classification of LSE types can provide information about species distributions This thesis investigates this approach, using the Indian Remote Sensing Satellite IRS 1B imagery

I approach this problem through investigations at three different spatial scales First distribution parameters (mean standard deviation skew and kurtosis) of the Normalised Difference Vegetation Index, which is believed to be correlated with vegetation biomass and vigour, are used to map the Western Ghats and west coast of India an area of 170,000 sq km, at a broad (1 10^6) scale into different types of landscapes

An unsupervised classification is carried out, followed by the merger of smaller patches with the most prevalent landscape type in the vicinity to assign the region to a remaining 205 patches belonging to eleven types of landscapes The distribution of these eleven types is then compared with topography, rainfall, temperature, population, agriculture and vegetation data for interpretation It is

suggested that a sample landscape be mapped and species distributions studied in each of these patches Such data can then be extrapolated to obtain information about species diversity in the Western Ghats

At the second spatial scale detailed landscape mapping at a scale of 1 25 000 is carried out in twelve landscapes distributed across the Ghats 10 50 sq km in area using supervised classification with initial field input and unsupervised classification without such input These twelve landscapes belong to five of the eleven landscape types which were mapped across the Ghats A total of 24 LSE types are encountered in these twelve landscapes

The accuracy of unsupervised classification is found to be much lower than that of supervised classification Landscape and LSE type characteristics landscape diversity patch size patch shape and distance to the nearest neighbour of the same type calculated using the supervised classification differ significantly from those calculated using unsupervised classification Unsupervised classification at this scale, therefore does not provide accurate information either for landscape mapping or for deriving information about landscape characteristics

However within-landscape type variation in landscape characteristics is less than between type variation for all landscape characteristics considered This indicates that the NDVI based unsupervised classification carried out at a broader scale is useful in differentiating landscapes of different types, with different landscape characteristics

The twenty-four LSE types encountered in these twelve landscapes are clustered based on their patch areas shape and nearest neighbour distance to understand the relationship between them No distinct grouping of LSE types can be discerned probably because inter landscape variation in LSE type characteristics is very high This suggests that the influence of the landscape in determining patch characteristics is more than that of the LSE type

At the third spatial scale, a 30 sq km landscape in the Ghats (latitude $14^{\circ}16'$-$14^{\circ}19'$ N, longitude $74^{\circ}52'$-$74^{\circ}54'$ E) is mapped into seven LSE types, by supervised as well as unsupervised classification In this, all Angiosperms

(excluding grasses) distributed in these seven LSE types are surveyed in the field using 246 quadrats of 10 m by 10 m in order to assess whether these types could be distinguished on the basis of their species composition

LSE types as identified in the field and using supervised classification do harbour significantly distinctive sets of flowering plants whereas unsupervised classification does not permit classification of LSE types with a high enough degree of accuracy to achieve this LSE types coupled to satellite imagery are therefore a useful device for organising a programme of assessing and monitoring species diversity

An important component of monitoring is to assess the efficacy of conservation efforts A methodology is suggested for this purpose and applied to this landscape First based on interviews with local informants a Landscape Transformation Matrix is prepared, describing the projected probabilities of transformation over the next five years LSE types are then assigned conservation values as the sum of values (evergreenness endemicity to the Ghats, medicinal nature or being a wild relative of cultivated plants) of the species which they harbour

Finally for each transformation from one LSE type to another the desirability of transformation is calculated as the product of the likelihood of its occurrence and the gain/loss in value which will result These desirabilities of transformation could serve as useful inputs to include biodiversity considerations into developmental planning at the local level

The methodology proposed in this thesis of broad scale landscape mapping coupled with point sampling of LSE type and species distribution, is therefore a useful one for assessing and monitoring species diversity in the Western Ghats This is possibly the first exercise in which methodology for an exercise of biodiversity assessment at different spatial scales has been formulated and tested, using a combination of satellite imagery and ground based species sampling, and linkages between information at these various scales established

Based on these results a proposal for biodiversity assessment monitoring and conservation in the Western Ghats of India is suggested There are of course questions which still need to be answered in order to repeat this exercise at a larger Ghats wide scale These are also discussed